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# Claims

[c1] 1. A method for laterally steering a streamer cable towed underwater with a bird assembly rotatably attached to the streamer cable, the bird assembly being of the type typically operated underwater in an orientation wherein one or more wings on the bird assembly are pivotable about one or more pivot axes lying generally in a horizontal plane, the method comprising:

operating the bird assembly in an orientation wherein the one or more pivot axes of the wings lie largely in a vertical plane.

[c2] 2. The method of claim 1 comprising:

preadjusting the specific gravity of the bird assembly so that the bird assembly operates underwater in an orientation wherein the one or more pivot axes of the one or more wings lie largely in a vertical plane.

[c3] 3. The method of claim 2 comprising:

making one of the wings heavier than another.

[c4] 4. The method of claim 2 comprising:

adding a weight to one of the wings.

[c5] 5. The method of claim 2 comprising:

forming a void in the interior of one or more of the wings.

[c6] 6. The method of claim 2 comprising:

adding flotation to the bird assembly.

[c7] 7. The method of claim 6 wherein the flotation is added to the bird assembly at a position on the same side of the cable as the one or more wings.

[c8] 8. The method of claim 1 comprising:

ballasting the bird assembly so that the bird assembly operates underwater in an orientation wherein the one or more pivot axes of the one or more wings lie largely in a vertical plane.

[c9] 9. The method of claim 1 comprising:

controlling an aileron positioned on the bird assembly to maintain the bird assembly underwater in an orientation wherein the one or more pivot axes of the one or more wings lie largely in a vertical plane.

[c10] 10. The method of claim 1 comprising:

changing the angles of the one or more wings on the bird relative to each other to maintain the bird assembly underwater in an orientation wherein the one or more pivot axes of the one or more wings lie

largely in a vertical plane.

[c11] 11. The method of claim 1 further comprising:
operating a second bird assembly on an opposite side of the streamer cable from the other bird assembly.

[c12] 12. A method for converting a cable-leveling bird having a pair of wings into a cable-steering bird, the method comprising:
ballasting the cable-leveling bird so that the bird operates underwater in an orientation wherein each of the wings pivots about a pivot axis that lies largely in a vertical plane to steer an attached underwater cable laterally.

[c13] 13. The method of claim 12 comprising:
making one of the wings heavier than the other.

[c14] 14. The method of claim 12 comprising:
adding a weight to one of the wings.

[c15] 15. The method of claim 12 comprising:
forming a void in the interior of one of the wings.

[c16] 16. The method of claim 15 further comprising:
filling the void with a foam material having a specific gravity less than unity.

[c17] 17. The method of claim 12 further comprising:
adding an orientation sensor to the bird for providing a signal representative of the orientation of the bird.

[c18] 18. An underwater cable steering device comprising:
a connector attachable around the periphery of an underwater cable and rotatable about the cable;
a control device including:
a body connected to the connector external of the cable;
a first wing disposed at one side of the body and arranged to pivot about a first axis;
a second wing disposed at an opposite second side of the body and arranged to pivot about a second axis;
wherein the first axis and the second axis do not intersect the cable;
means for pivoting the first wing about the first axis and the second wing about the second axis;
ballast means to help ballast the steering device to maintain the first axis and the second axis largely vertically disposed.

[c19] 19. A device as in claim 18 wherein the ballast means includes a weighted portion in the first wing.

[c20] 20. A device as in claim 18 wherein the ballast means includes a foamed portion in the second wing less dense than the rest of the second wing.

[c21] 21. A device as in claim 18 wherein the first and second wings each include hollowed portions.

[c22] 22. A device as in claim 18 wherein the first and second wings each include tanks at the wing tips.

[c23] 23. A device as in claim 18 wherein the means for pivoting comprises:

a first shaft extending out of the first side of the body and affixed to the first wing and defining the first axis;

a second shaft extending out of the second side of the body and affixed to the second wing and defining the second axis;

a drive mechanism connected to the first shaft and the second shaft to rotate the first shaft along the first axis and the second shaft along the second axis, thereby to adjust the angle of attack of the wings.

[c24] 24. A device as in claim 22 wherein the first shaft and the second shaft are axially aligned.

[c25] 25. A device as in claim 22 wherein the first shaft and

the second shaft are opposite ends of the same shaft.

[c26] 26. A device as in claim 22 wherein the drive mechanism includes a first actuator coupled to the first wing and a second actuator coupled to the second wing.

[c27] 27. A device as in claim 22 wherein the drive mechanism includes an actuator coupled to both wings.

[c28] 28. A device as in claim 18 wherein the control device includes an orientation sensor producing a signal representing the orientation of the body.

[c29] 29. A device as in claim 18 wherein the control device includes an accelerometer producing a signal representing the acceleration of the body through the water.

[c30] 30. A device as in claim 18 wherein the first wing is heavier than the second wing.

[c31] 31. A device as in claim 18 wherein the ballast means comprises a negatively buoyant body attached to the connector at a circumferentially offset position from the control device around the periphery of the connector.

[c32] 32. A device as in claim 18 wherein the ballast means includes a positively buoyant appendage extending from the body.

[c33] 33. A device as in claim 18 wherein the ballast means includes a weight in the first wing.

[c34] 34. A device as in claim 18 wherein the ballast means includes a float attached to the connector.

[c35] 35. A device as in claim 18 further comprising a second control device connected to the connector on the opposite side of the underwater cable from the other control device.

[c36] 36. An underwater cable steering device comprising:

a connector attachable around the periphery of an underwater cable and rotatable about the cable;

a control device including:

a body connected to the connector external of the cable;

a shaft extending through the body and defining a pivot axis;

a first wing portion connected to one end of the shaft at one side of the body to pivot about the pivot axis;

a second wing portion connected to the opposite end of the shaft at an opposite side of the body to pivot about the pivot axis;

wherein the pivot axis does not intersect the cable;

ballast means to help ballast the steering device to maintain the pivot axis largely vertically disposed.

[c37] 37. A device as in claim 36 further comprising a second control device connected to the connector on the opposite side of the underwater cable from the other control device.

[c38] 38. A device as in claim 36 wherein the ballast means includes a weighted portion in the first wing portion.

[c39] 39. A device as in claim 36 wherein the ballast means includes a foamed portion in the second wing portion less dense than the rest of the second wing portion.

[c40] 40. A device as in claim 36 wherein the first and second wing portions each include hollowed portions.

[c41] 41. A device as in claim 36 wherein the means for pivoting comprises:

a drive mechanism connected to the shaft to rotate the shaft about the pivot axis to adjust the angle of attack of the wing portions.

[c42] 42. A device as in claim 41 wherein the drive mechanism includes an actuator coupled to both wing portions.

[c43] 43. A device as in claim 36 wherein the control device includes an orientation sensor producing a signal repre-

senting the orientation of the body.

[c44] 44. A device as in claim 36 wherein the control device includes an accelerometer producing a signal representing the acceleration of the body through the water.

[c45] 45. A device as in claim 36 wherein the first wing portion is heavier than the second wing portion.

[c46] 46. A device as in claim 36 wherein the ballast means comprises a negatively buoyant body attached to the connector at a circumferentially offset position from the control device around the periphery of the connector.

[c47] 47. A device as in claim 36 wherein the ballast means includes a positively buoyant appendage extending from the body.

[c48] 48. A device as in claim 36 wherein the ballast means includes a weight in the first wing portion.

[c49] 49. A device as in claim 36 wherein the ballast means includes a float attached to the connector.

[c50] 50. A device as in claim 36 wherein the first wing portion and the second wing portion are unitarily formed.

[c51] 51. An underwater cable steering device comprising:

a connector attachable around the periphery of an

underwater cable and rotatable about the cable;

a control device including:

a body connected to the connector external of the cable;

a first shaft extending from a first side of the body;

a first wing attached to an end of the first shaft and arranged to pivot about a first axis defined by the axial rotation of the first shaft;

wherein the first axis does not intersect the cable;

ballast means to help ballast the steering device to maintain the first axis largely vertically disposed.

[c52] 52. A device as in claim 51 further comprising a second control device connected to the connector on the opposite side of the underwater cable from the other control device.

[c53] 53. A device as in claim 51 wherein the ballast means includes a weighted portion in the first wing.

[c54] 54. A device as in claim 51 wherein the ballast means includes a foamed portion in the first wing less dense than the rest of the first wing.

[c55] 55. A device as in claim 51 wherein the ballast means includes a hollowed portion in the first wing.

[c56] 56. A device as in claim 51 wherein the first wing includes a tank at the wing tip.

[c57] 57. A device as in claim 51 wherein the control device further includes:

a second wing attached to an end of the first shaft opposite the first wing and arranged to pivot about the first axis defined by the axial rotation of the first shaft.

[c58] 58. A device as in claim 51 wherein the control device further includes:

a second wing disposed at an opposite second side of the body from the first wing and arranged to pivot about a second axis;

wherein the first axis and the second axis do not intersect the cable.

[c59] 59. A device as in claim 58 wherein the means for pivoting comprises:

a second shaft extending out of the second side of the body and affixed to the second wing and defining the second axis;

a drive mechanism connected to the first shaft and the second shaft to rotate the first shaft along the first axis and the second shaft along the second axis, thereby to adjust the angle of attack of the wings.

[c60] 60. A device as in claim 59 wherein the first shaft and the second shaft are axially aligned.

[c61] 61. A device as in claim 59 wherein the first shaft and the second shaft are opposite ends of the same shaft.

[c62] 62. A device as in claim 59 wherein the drive mechanism includes a first actuator coupled to the first wing and a second actuator coupled to the second wing.

[c63] 63. A device as in claim 59 wherein the drive mechanism includes an actuator coupled to both wings.

[c64] 64. A device as in claim 51 wherein the control device includes an orientation sensor producing a signal representing the orientation of the body.

[c65] 65. A device as in claim 51 wherein the control device includes an accelerometer producing a signal representing the acceleration of the body through the water.

[c66] 66. A device as in claim 58 wherein the first wing is heavier than the second wing.

[c67] 67. A device as in claim 51 wherein the ballast means comprises a negatively buoyant body attached to the connector at a circumferentially offset position from the control device around the periphery of the connector.

[c68] 68. A device as in claim 51 wherein the ballast means includes a positively buoyant appendage extending from the body.

[c69] 69. A device as in claim 51 wherein the ballast means includes a float attached to the connector.